

Enhancing English listening and comprehension skills through interactive e-content: a quasi-experimental study

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ABSTRACT

This study delves into the effect of interactive e-content on enhancing listening skills and language comprehension through a quasi-experimental approach. The 200 secondary school students from eighth standard were randomly divided into groups. The researchers executed pre-test to assess the initial language skills of the learners. Experimental group was taught with interactive e-content, control group underwent traditional teaching. The intervention was followed by post-test. SPSS was used to analyze the data descriptive statistics and t-value specified significant enhancements in the experimental group. Pre-test and post-test t-value of control group was 58.4 and experimental group was 146.14, demonstrating substantial progress in listening skills. Post-test t-value of both groups was 31.09 ($p < 0.01$), approving superior effect of interactive e-content enhancing listening skills. For language comprehension, pre-test and post-test t-value of control group was 70.23 and experimental group was 113.11. Post-test t-value of both groups was 28.05 ($p < 0.01$) conforming greater improvement for experimental group. The t-value of the rural 38.45 and urban 44.18 reveals more significant advancement, implying interactive e-content is effective for enhancing listening skills and language comprehension for both rural and urban students. The study recommends conducting further research on the impact of interactive e-content on reading and speaking skills in English language.

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1. INTRODUCTION

The swift progress of technology has transformed the educational process, using creative strategies, innovative approaches to improve learners' participation and learning outcomes [1]. Conventional teaching approaches need to adapt digital resources to promote interactive and effective learning experiences [2]. The application of multisensory learning plays a vital role in engaging learners with visual, auditory, and interactive components [3]. This strategy promotes comprehension and reinforces learners' connection with the educational content. Multimedia enriched learning contents like animation video, audio contents, interactive quizzes foster English language learning [4]. The interactive e-content advances learner involvement, sustains learner commitment, maintains motivation and meets the varied learning styles in language classes and enhance listening skills and language comprehension [5]. Listening skills and language comprehension are essential for mastery of English language predominantly for secondary learners during crucial language learning phases [6]. It promotes retention, and boost English proficiency [7]. Language

games, immediate feedbacks, contextualized learning activities, listening skill task deepen conceptual understanding and deliver meaningful learning experiences [8].

This study examines the effect of interactive e-content on enhancing listening skills and language comprehension among secondary school students based on rural and urban locality. To meet the aim, the researchers developed and applied 20 interactive e-content in English language. Moving beyond theory, the study examines the tangible influence of technology-enhanced learning strategies on students' listening and comprehension skills. Prior studies in multimedia based English language learning often neglected direct rural and urban comparisons and paid little attention to scholar engagement to long-term interventions. Existing researchers are based on the reading and vocabulary enrichment skill and focused on short-term outcomes leaving a gap to find how interactive-content can enhance listening skills and language comprehension. To bridge the gap, the researchers developed interactive e-content to enhance listening skill and language comprehension and used the same intervention to compare the language learning achievement of the urban and rural students. Reflecting the goals of the National Education Policy (NEP) 2019, the study promotes digital equity by confirming access to quality interactive e-content for students in rural and urban schools, fostering self-directed, and technology enabled learning [9]. The research questions are: how interactive e-content advances listening skills and language comprehension in English language among secondary school students, also investigate locality-based variances in its impact. By addressing these questions, the study expands the educational technology and its practical implication in the English skill especially listening skill and language comprehension.

2. THE COMPREHENSIVE THEORETICAL BASIS

The study is guided by Mayer's multimedia learning theory [10], which highlights the importance of combining images, words, interactivity to facilitate deeper learning. The theory is grounded on the concept of dual-channel processing, asserts that learner imbibes information more efficiently through the combined presentation of visual and verbal inputs of knowledge. In the process of interactive e-content development the researchers used spiral and temporal contiguity, text-visual integration, omitting extraneous material the central principles of the theory. Organized and systematically designed visual images, text, audio-video contents, aligning associated content and interactive quizzes deliver profound insights, greater grasp, learner engagement and enhanced retention. The study is grounded in Deci and Ryan's self-determination theory [11], which underscores how intrinsic motivation promotes productive learning. The theory outlines three core psychological need relatedness, competence and autonomy. The developed interactive e-content addressed these needs by offering self-directed learning choices, interesting and challenging tasks, collaboration and peer feedback. These features encourage self-efficacy, learner autonomy and sustained motivation. The e-content modules employ dual channel processing to retain the information and incorporate actives to create intrinsic motivation, learner participation for improving listening and language comprehension.

3. METHOD

The study employed quasi-experimental research with pre-test-post-test two group design. The population of the study was secondary school students. Schools were chosen using stratified purposive sampling technique to ensure internet access, computer facilities, enrollment of at least 150 learners in grade 8, with gender balance sustained among learners and instruction delivered in English. The study selected two schools one from an urban and the other from a rural locality. Out of 300 learners, 200 were selected from standard 8, all aged 13 years, with an equal distribution of 100 male and 100 female students considering an equal level of language proficiency. Each of the 200 eligible students was allocated unique identification numbers, and four groups were formed based on the computer-generated random number system. The four groups were experimental urban, experimental rural, control urban and control rural each group comprises 50 samples including 25 boys and 25 girls. Gender balance was preserved within all groups to ensure comparable initial language proficiency. This approach maintained equal group composition and minimized risk of allocation bias. The objective of the study was to assess the effect of interactive e-content for enhancing listening skills and language comprehension in English language among secondary school students. The study implemented a three-phase structured process: pre-test, to test the prior knowledge of listening skills and language comprehension; Intervention, where experimental group was taught with interactive e-content and control group underwent traditional teaching method and post-test, where listening skills and language comprehension were reassessed. The descriptive statistics paired t-test and independent sample t-test was used to analyze the significance of differences between pre-test and post-test scores to evaluate the impact of interactive e-content on listening skills and language comprehension in English language among secondary school students based on locality.

3.1. Validity and reliability of interactive e-content in English language

A total number of 20 interactive e-modules were developed by the researchers¹⁰ targeting listening skills and 10 focusing language comprehension. The modules were designed for 45 minutes, involving interaction with video, audio, peer and teacher. Click-and-reveal, multiple-choice questions and drag-and-drop, sound effects, voice narration are the technical features used to make e-content interesting. The use of decision pathways, interactive quizzes, and language games, milestone indicators, status trackers stimulated listening. It encourages learner independence, instant feedback, absorbing phonetic patterns and language structure. Interactive e-content was validated by the experts. The average mean score of the content expert validation is 94.5%, and the media expert validation is 90.5%, rated as 'very good', revealing that developed interactive e-content is valid for teaching and learning. Figure 1 shows the interactive e-content, Interactive video is presented in Figure 1(a), interactive quizzes in Figure 1(b) and interactive modules in Figure 1(c) these are the interactive e-content developed by the researchers.

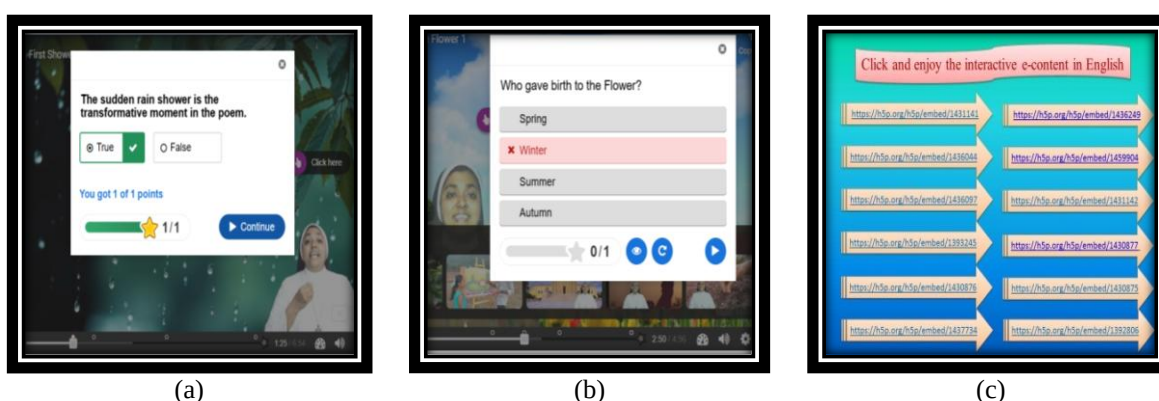


Figure 1. Interactive e-content (a) interactive video, (b) interactive quizzes, and (c) interactive modules

3.2. Validity and reliability of tools for testing listening skills and language comprehension in English language

The researchers conducted a pilot study to measure the validity and reliability of the tools. The sample included 100 eighth-grade students from Soccorso Convent HSS Kottakkal Mala, Kerala, India. The researchers informed the school authorities of the objectives and obtained their consent for the test. Each tool consisted of 46 questions and provided 45 minutes for completion of the test. The test items were removed from the tool according to the results of the pilot study. The difficulty index and the discrimination index were found. Items were retained only if they satisfied the criteria, difficulty levels ranging between 20% and 80%, and discrimination values between -1 and +1. Items falling outside these acceptable ranges were excluded. Out of 46 test items, 6 questions were rejected from each test. The difficulty index, which shows the percentage of pupils who responded an item properly, was calculated by:

$$\text{Difficulty index} = \frac{\text{Number of correct responses} \times 100}{\text{Total number of students}}$$

the discrimination index measures how well an item differentiates between high and low performers. It is calculated using the formula suggested by Kelley [12]:

$$\text{Discrimination index} = \frac{N_H - N_L}{N}$$

where: N_H is the number of correct responses from the top 27% of scorers; N_L is the number of correct responses from the bottom 27%; and N is the total number of students.

Reliability of listening skills test and language comprehension test was found by using Kuder-Richardson reliability index (KR20) [13]. The test item has only one right answer, and each right answer carries one mark, and each wrong answer carries zero marks. The 40 items of final listening skills pre-test were analyzed with the KR-20 the result of 0.9, post-rest 0.92, language comprehension pre-test 0.87, and post-test 0.89 revealing that the test items are highly reliable. KR20 was calculated using the formula:

$$KR20 = \frac{N}{N-1} \left(1 - \frac{\sum pq}{\sigma^2} \right)$$

where: N is number of items, σ is sum of the variance, p is sum of the correct responses, and q is sum of the wrong responses.

4. RESULTS

4.1. Test the effect of interactive e-content on the listening skills

The researchers collected, categorized, and tested the normality of the data. The researchers administered Shapiro-Wilk test to measure the normality of the data. The test values 0.86 and 0.98 reveals that the data were normally distributed. Levene's test was used to test the homogeneity of variance [14]. The results 0.76 and 0.85 indicate that the variances were equal across groups for the pre- and post-test of listening skills. The data were analyzed for the pre- and post-test results of the listening skills for the total sample of the experimental group and the control group, and based on rural and urban localities. The researchers used SPSS to find the descriptive statistics, such as mean and standard deviation, to understand the attained score of the control group and experimental group at the same time, the achievement based on the locality of the secondary school students. Found t-value to measure and compare the significant difference between the groups.

4.1.1. Test of significance for difference between mean of pre-test and post-test scores on listening skills test of control and experimental group

The paired t-test results showed a statistically significant improvement in listening skills for both control and experimental groups. Table 1 and Figure 2 present the control group's pre-test mean was 14.64 (SD=1.19), increasing to 29.66 (SD=2.56) in the post-test. The t-value was 58.44, with a p-value of <0.001, indicating significant improvement. The experimental group's pre-test mean was 14.59 (SD=1.10), rising to 37.58 (SD=1.42) in the post-test. Its t-value was 146.14, also with a p-value of <0.001, confirming a highly significant improvement. Both groups started with similar pre-test scores, suggesting a comparable baseline. This ensures the validity of the comparison between the two instructional methods. The increase in post-test scores indicates that both conventional and interactive methods were effective. Cohen's d of the control group showed a very large effect size (d=7.52), while the experimental group demonstrated an extremely large effect size (d=18.10), indicating substantially greater improvement with interactive e-content compared to conventional teaching. This highlights the stronger impact of interactive e-content in enhancing students' listening skills.

Table 1. Pre-test and post-test scores on listening skills test

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Control group	Pre-test	100	14.64	1.19	58.44	<0.0001**	7.52
	Post-test	100	29.66	2.56			
Experimental group	Pre-test	100	14.59	1.10	146.14	<0.0001**	18.10
	Post-test	100	37.58	1.42			

Note: **denotes significant at 1% level.

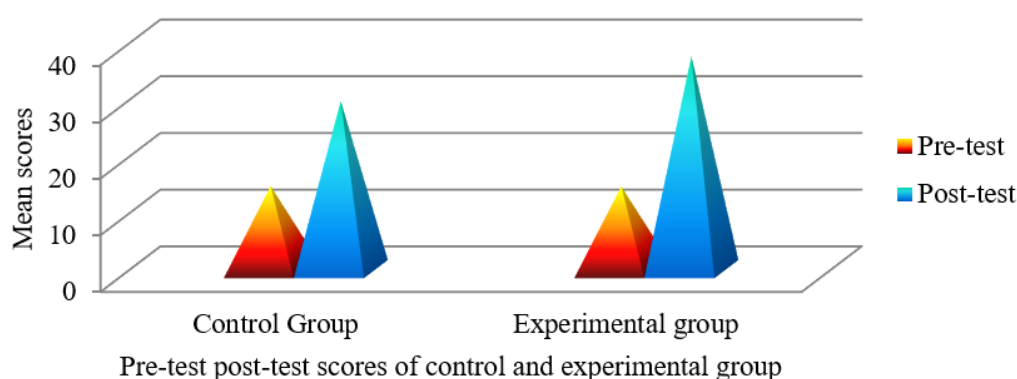


Figure 2. Pre-test and post-test scores on listening skills test

4.1.2. Test of significance for difference between mean of post-test scores on listening skills test of control and experimental group

The independent sample t-test results demonstrate a significant difference between the control and experimental groups concerning their post-test scores on the listening skills test. Table 2 reveals that the mean scores for the control and experimental groups are 29.66 and 37.58, respectively, with standard deviations of 2.56 and 1.42. The computed t-value of 31.09 and the corresponding p-value of 0.0001, which is below the conventional significance threshold of 0.01, indicate that the observed difference in mean scores is statistically significant. A Cohen's d of 3.83 is extremely large, far exceeding the threshold of 0.8 for a large effect. This suggests a very strong impact of the interactive e-content on students' performance in the experimental group compared to the control group. The findings suggest that interactive e-content is more effective than conventional teaching methods. The results were not influenced by extraneous variables, as the same instructor taught all groups over a six-month period. It enhances students' listening skills by improving sub-skills such as coherence and cohesion, lexical resource, grammatical range and accuracy, and task achievement.

Table 2. Post-test scores on listening skills test

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Post-test	Control group	100	29.66	2.56	31.09	<0.0001**	3.83
	Experimental group	100	37.58	1.42			

Note: **denotes significant at 1% level.

4.1.3. Test of significance for difference between mean of pre-test and post-test scores on listening skill test of rural and urban secondary school students

The paired t-test analysis shows a significant improvement in listening skills for both rural and urban students. Table 3 shows that the rural students' mean scores increased from 14.62 to 33.05, with a t-value of 38.45 and a p-value of 0.0001. Urban students also improved, with scores rising from 14.61 to 34.13, and a t-value of 44.18 and the same p-value. These results confirm that the score increases for both groups are statistically significant. Table 3 shows similar pre-test scores for both groups, indicating a comparable baseline. This ensures that the improvements can be attributed to the interactive e-content intervention. Cohen's d indicated a very large effect for both groups, with the rural locality showing d=5.43 and the urban locality showing d=6.27. These results suggest substantial improvement in both settings; with the urban group exhibiting a slightly greater gain in listening skills and language comprehension. The findings highlight the effectiveness of interactive e-content in enhancing listening skills across diverse settings.

Table 3. Pre-test and post-test scores on listening skill test based on locality

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Rural locality	Pre-test	100	14.62	1.14	38.45	<0.0001**	5.43
	Post-test	100	33.05	4.66			
Urban locality	Pre-test	100	14.61	1.16	44.18	<0.0001**	6.27
	Post-test	100	34.13	4.25			

Note: **denotes significant at 1% level.

4.1.4. Test of significance for difference between mean of post-test scores on listening skill test of rural and urban secondary school students

The Table 4 shows the independent sample t-test of post-test scores of students from urban (M=34.13, SD=4.25) and rural (M=33.05, SD=4.66) localities revealed no statistically significant difference, t=1.71, p=0.089, Cohen's d=0.24, indicating a small effect size. This suggests that, from a statistical standpoint, the geographical setting did not substantially influence student performance. The findings indicate that interactive e-content is equally effective for both urban and rural students, as no statistically significant difference was observed between their post-test scores. This suggests that the digital intervention can be successfully implemented across diverse educational settings regardless of geographic location.

Table 4. Post-test scores on listening skill test based on locality

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Post-test	Rural locality	100	33.05	4.66	1.71	0.089	0.24
	Urban locality	100	34.13	4.25			

4.2. Test the effect of interactive e-content on language comprehension

The researchers conducted pre- and post-language comprehension tests of experimental and control groups. The data were categorized, and the normality of the data was verified. The Shapiro-Wilk test was used to evaluate the normality of the data. The results of 0.72 and 0.86 disclose that the data were normally distributed. Levene's test [14] results of 0.78 and 0.89 specify that the variances were equal across groups in the language comprehension pre-test and post-test. The data were analyzed for the pre- and post-test results of the language comprehension for the total sample and the sub-samples of rural and urban localities of the experimental group and the control group. SPSS provided the mean and standard deviation, and t-value to assess the effect of language comprehension.

4.2.1. Test of significance for difference between mean of pre-test and post-test scores on language comprehension test of control and experimental group

The paired t-test analysis shows a significant improvement in language comprehension for both control and experimental groups. Table 5 and Figure 3 show that the control group's mean score increased from 15.45 to 30.83, with a t-value of 70.23 and a p-value of 0.0001. The experimental group's mean score rose from 15.37 to 37.38, with a t-value of 113.11 and the same p-value. These results confirm that both improvements are statistically significant. Pre-test scores were similar across groups, indicating a comparable baseline. This supports the validity of comparing post-test results. Cohen's d showed a very large effect size for the control group ($d=9.94$) and an extremely large effect size for the experimental group ($d=15.99$). This indicates that both groups improved markedly, with the interactive e-content producing a substantially greater impact than conventional teaching. This highlights the more substantial impact of interactive e-content on enhancing language comprehension.

Table 5. Pre-test and post-test scores on language comprehension test

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Control group	Pre-test	100	15.45	0.91	70.23	<0.0001**	9.94
	Post-test	100	30.83	1.99			
Experimental group	Pre-test	100	15.37	1.32	113.11	<0.0001**	15.99
	Post-test	100	37.38	1.43			

Note: **denotes significant at 1% level.

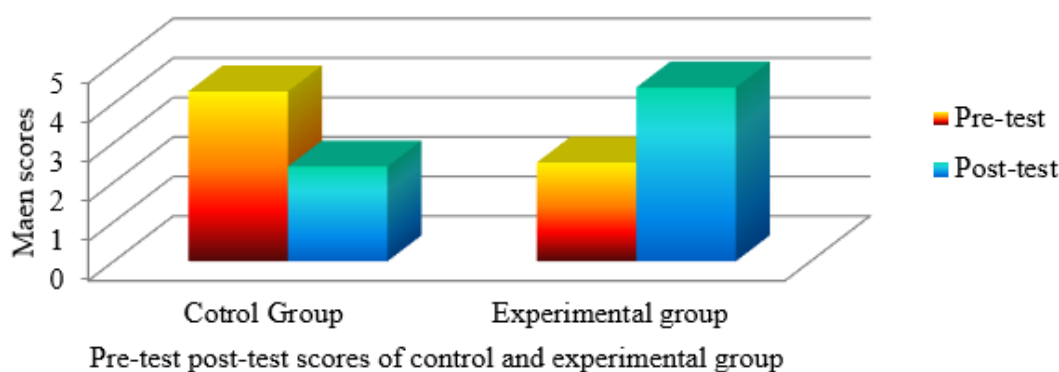


Figure 3. Pre-test and post-test scores on language comprehension test

4.2.2. Test of significance for difference between mean of post-test scores on language comprehension test of control and experimental group

The independent sample t-test results show a significant difference in post-test language comprehension scores between control and experimental. Table 6 displays that rural students had a mean score of 30.83 (SD=1.99), while urban students scored 37.38 (SD=1.43). The t-value of 28.08 and p-value of 0.0001 confirm that this difference is statistically significant. Cohen's d for the post-test scores was 3.78, indicating an extremely large effect size. This shows that the experimental group outperformed the control group by a substantial margin after the intervention. These findings demonstrate the greater effectiveness of interactive e-content, particularly in enhancing comprehension skills. It supports the development of vocabulary, inferential reasoning, and understanding of key ideas. Interactive e-content also promotes deeper engagement, personalized learning, and improved language proficiency for diverse learners.

Table 6. Post-test scores on language comprehension test

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Post-test	Control group	100	30.83	1.99	28.08	<0.0001**	3.78
	Experimental group	100	37.38	1.43			

Note: **denotes significant at 1% level.

4.2.3. Test of significance for difference between mean of pre-test and post-test scores on language comprehension test of rural and urban locality

The paired t-test analysis reveals a significant improvement in language comprehension for both rural and urban students. Table 7 illustrate that the rural students' mean scores increased from 15.45 to 33.54 (SD=0.91 and 3.81), with a t-value of 45.31 and a p-value of 0.0001. Urban students also improved, with scores rising from 15.44 to 34.67 (SD=1.01 and 3.54), yielding a t-value of 52.25 and the same p-value. These results confirm that the gains in both groups are statistically significant. Cohen's d for the rural locality was 6.75, while for the urban locality it was 7.17, both indicating extremely large effect sizes. These results show marked improvement in listening skills and language comprehension in both settings, with slightly higher gains in the urban group. The use of interactive e-content vigorously involved students and upgraded their thoughtfulness, provide engaging and pedagogically sound experiences environment for rural and urban students. Overall, the intervention effectively enhanced language comprehension among rural and urban learners.

Table 7. Pre-test and post-test scores language comprehension test based on locality

Factor	Category	Number of students	Mean	Standard deviation	t- value	p-value	Cohen's d
Rural locality	Pre-test	100	15.45	0.91	45.31	<0.0001**	6.75
	Post-test	100	33.54	3.81			
Urban locality	Pre-test	100	15.44	1.01	52.25	<0.0001**	7.17
	Post-test	100	34.67	3.54			

Note: ** denotes significant at 1% level.

4.2.4. Test of significance for difference between mean of post-test scores on language comprehension test of rural and urban secondary school students

The independent t-test values in the Table 8 revealed a statistically significant difference in post-test scores between rural and urban students ($t=2.17$, $p=0.031$). Urban students achieved a higher mean score ($M=34.67$) compared to their rural counterparts ($M=33.54$). The effect size, measured by Cohen's d 0.24, indicates a small to moderate difference. This suggests that locality had a modest influence on students' post-test performance, with urban students showing a slight advantage. Interactive e-content effectively enhances contextual vocabulary, gist capture, key concept identification, inferential reasoning, and content organization for both urban and rural students.

The study controlled extraneous variables using the same instructor for both groups to neutralize instructional enthusiasm and extended the intervention time limit to six months to reduce novelty effects. This enriched the reliability of the score to analysis the effect of interactive-content. The study controlled extraneous variables using the same instructor for both groups to neutralize instructional enthusiasm and extended the intervention time limit to six months to reduce novelty effects. This enriched the reliability of the score to analysis the effect of interactive-content. The implementation of the interactive e-content not only improved the scores but also fostered self-paced learning, peer engagement, collaboration and learning outcome. Experimental group exhibited significant progress, deeper comprehension, and enhanced focus due to the multisensory nature the interactive e-content. The five-mode interaction model; video interaction, audio interaction, peer interaction, teacher student interaction and interactive quizzes provide diverse learning content and meets the need of the students. The equal effect of the interactive e-content in rural and urban locality reveals its scalability and potential to narrow educational inequalities. Practically, this study found that the developed interactive e-content modules are beneficial pedagogical tool, to build lexical competence, enrich pronunciation, and enhanced listening and comprehension skills. It improves holistic language skills and communication ability.

Table 8. Post-test scores on language comprehension skill test based on locality

Factor	Category	Number of students	Mean	Standard deviation	t-value	p-value	Cohen's d
Post-test	Rural locality	100	33.54	3.81	2.17	0.031	0.24
	Urban locality	100	34.67	3.54			

5. DISCUSSION

The findings of the analysis, pre-test scores of experimental and control groups exhibited the lack of prior knowledge before the intervention. The pre-test and post-test t-value proves that the experimental group attained significant improvement emphasizing the effect of developed interactive e-content to enhance students' listening skills and language comprehension in English. The pre-test t-value >0.05 (not statistically significant) of urban and rural students show that a limited prior knowledge in listening skills and language comprehension based on the locality. The pre-test and post-test t-value <0.01 (statistically significant) of urban and rural students specifies a significant advancement in the language skills. The researcher developed and implemented this technological intervention in remote areas to support students' learning, aligning with the recommendations of the New Education Policy 2019. The interactive e-content makes English classes enthusiastic, creative through the systematic organization of content, engaging framework and immediate feedbacks. This integrates five mode interactions: video, audio interaction, teacher-students interaction, peer collaboration, self-directed learning and interaction with interactive quizzes. These interactive elements promote student participation and multiple learning styles [15]. It develops pronunciation accuracy, expands vocabulary, advances fluency encourages critical thinking, improves listening skills and overall language comprehension [16], [17]. Phonetic transcription provides an organized approach to recognize and articulate unfamiliar vocabulary.

The crucial aspect of interactive e-content is the incorporation of various learning tools, including quizzes, highlighted vocabulary, images, and language-based games [18]. These elements create an engaging and stimulating learning environment that enhances knowledge retention [19]. Interactive quizzes provide instant feedback, allowing students to assess their understanding and identify areas for improvement. Highlighted vocabulary helps learners focus on essential words and phrases, reinforcing language acquisition. Language games, on the other hand, make the learning process enjoyable, reducing the stress associated with traditional learning methods [20]. Peer collaboration plays a significant role in interactive e-learning by encouraging students to engage in discussions, group activities, and language exercises with their peers. Collaborative learning fosters critical thinking and enhances problem-solving abilities [21]. It also helps develop effective communication skills. By working together, students gain exposure to different perspectives and language expressions, which enhances their understanding and application of English in real-life contexts. Additionally, teacher-student interaction is, facilitated through virtual classrooms, feedback sessions, and personalized guidance, ensures that students receive the necessary support to overcome learning challenges [22]. It allows students to learn at their own pace and convenience [23] and promotes autonomous learning, empowering students to take responsibility for their education and develop self-discipline in their learning habits [24]. By actively engaging with the content, students construct their understanding rather than passively receiving information. The technology integrated educational approach also encourages experiential learning, where students learn by doing, leading to deeper comprehension and long-term retention [25].

The study was confined to two schools, included 200 students from grade 8 with equal consideration to male and female participants also involving rural and urban locality. Results may not be directly applicable to students in different regions, educational boards (e.g., Central Board of Secondary Education or CBSE, Indian Certificate of Secondary Education or ICSE), or linguistic backgrounds without further validation. The study was limited to listening skills and language comprehension omitting the reading, speaking, writing and grammar learning the other major domains of English language. Hence, the results are specific to receptive language skills and do not capture the full spectrum of language proficiency. The findings cannot be generalizable for long-term retention of learning or transfer of learning because the duration of the intervention was only six months. Follow-up studies would be needed to measure the durability of learning outcomes. The efforts were made to control for teacher bias and external influences, variables such as student motivation, home support, and previous exposure to technology were not fully controlled and may have influenced outcomes. While the findings provide a valuable foundation for expanding digital pedagogy, they should be interpreted within the context of the study's scope, and more extensive, diverse research is needed for broader generalization.

The distinctive contribution of this study is the design, development, and validation of interactive e-content aimed at improving listening skills and language comprehension in English among secondary school students. A key strength is its five-mode interaction model, engaging learners through e-content interaction, audio content engagement, peer collaboration, and teacher-student communication, thereby fostering active participation, creativity, and enthusiasm. The interactive e-content integrates multimedia features, phonetic support, interactive quizzes, and language games to create an inclusive, dynamic learning environment. Continuous assessment, immediate feedback, and self-paced activities guide and motivate students, building confidence and independence. Unlike earlier initiatives, this study demonstrates the equal effectiveness of digital interventions for both rural and urban learners, addressing educational disparities and aligning with the inclusive vision of the New Education Policy (NEP 2019). The findings provide practical, evidence-based

recommendations for policymakers and curriculum developers, emphasizing the need for systematic integration of technology-enabled interactive content in English language education. The model also supports teacher educators in preparing future teachers to adopt student-centered digital tools that enhance listening and comprehension skills. By offering a scalable and adaptable framework, the study illustrates how digital innovations can strengthen educational practices, close learning gaps, and promote a more digitally literate and inclusive society.

6. CONCLUSION

The findings of the study reveal that interactive e-content significantly enhances listening skills, language comprehension through creative and organized learning content. Digital tools, learner centered activities, collaboration, teacher-student interaction and immediate feedbacks establish dynamic atmosphere in the classroom. The significant improvement in the experimental group aligns with Mayer's cognitive theory of Multimedia Learning, as the interactive e-content effectively integrated verbal and visual channels to enhance processing and retention. These findings also support Deci and Ryan's self-determination theory, demonstrating the intervention fostered learner autonomy and intrinsic motivation, leading to greater engagement and achievement. Interactive e-content promotes learners' autonomy, confidence, and concentration. It makes classes more dynamic, digitally enriched and provides practical sessions. Policymakers can scale this approach by investing in digital infrastructure, offering teacher training, and ensuring equitable access for both rural and urban schools. The study may be influenced by potential biases such as the novelty effect of using digital tools and differences in students' digital literacy levels, which could have affected engagement and performance. Future research could include longitudinal studies to assess sustained impact, integrate speaking and writing skills, and replicate the intervention across different educational boards such as CBSE and ICSE.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**ding

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding this study. They have no financial, personal, or professional affiliations that could have influenced the research process or findings. All aspects of the study were conducted with transparency and academic integrity.

INFORMED CONSENT

The researchers informed the school authorities prior to data collection about the study's objectives, duration, and the mode of pre-test and post-test examinations. They also informed the parents about the nature of the study and kept the results confidential for data analysis.

ETHICAL APPROVAL

Before commencing the study, the researchers obtained Institutional Review Board (IRB) clearance from Christ Deemed to be University. This approval ensured that the research adhered to ethical guidelines, protecting the rights and well-being of all participants.

DATA AVAILABILITY

The researchers are willing to share the data supporting this study's findings, which are available from the corresponding author, [VN], on request.

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